

APPENDIX J

Options for the Use of Low-End Wood



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The Task Force identified some of the information that will be needed to fully evaluate the options for the use of low-end wood with regard to economic feasibility, wood requirements, and environmental impact.

Key questions to be addressed:

- 🌲 What are the characteristics of the problem material, i.e., what makes the material surplus to local manufacturers?
- 🌲 Are there other uses for the low-end wood products that have not been identified?
- 🌲 How much raw material is available and at what delivered cost?
- 🌲 Can the product be manufactured on a small scale? What is the smallest increment of capacity that will be economically feasible?
- 🌲 Will the product require raw material to be collected from many sources and delivered to a single site? If so, what kind of collection system will be necessary and how should it be paid for?
- 🌲 Is the product economically feasible to manufacture in Southeast? If not, why and what type/size of incentive would be necessary to bring this capability on-line in the region?
- 🌲 What are the target markets for the product and what is the market outlook over time?

The Task Force also identified a number of potential options for using low-end logs and residual fiber, many of which are briefly described below. In the past, studies have shown that some of these ideas are not economically feasible as stand-alone operations but may be feasible as cooperative ventures. Concerted effort will be needed to orchestrate the implementation of cooperatives or a publicly operated facility.

Round log export. Although Forest Service regulations generally prohibit log exports, the Regional Forester does have the authority to allow the export of timber that is “surplus to the needs of local manufacturers.” Since the KPC pulp mill closed, the Forest Service has allowed the export of small volumes of low end material on a case by case basis. One option would be to officially declare logs of grade No. 3 and lower as surplus to the needs of the industry and allow for them to be shipped out of the state without processing. This would allow timber sale purchasers to recover a portion of the cost of removing this material and allow them to focus their effort and investment in processing the larger, higher value timber.

Chip export. Whole-log chipping already occurs to some extent in the region. In the past, it helped to feed the KPC pulp mill and this may still be the best option for use of the utility logs. There is a danger of becoming overly reliant on the chip market, which is notoriously volatile.

Construction grade lumber. Manufacture of construction grade lumber is an option for the low-end logs and to some extent, the utility logs. A big question is whether Alaskan mills can compete with imports from the Pacific Northwest and Canada for the local market. Local markets generally require lumber to be graded and dried, which occurs to a limited extent in the region. At the very least, this option would allow for some cost recovery.

Medium Density Fiberboard (MDF). Worldwide, there has been a rapid expansion in MDF manufacturing capacity over the last few years. Following the curtailment of log exports from Malaysia, this product became widely accepted in Japan as a substitute for hardwood plywood. Producers capitalized on the excess demand seeking out cheaper and cheaper fiber sources. Today, new MDF plants tend to be located close to urban areas and rely on recycled wood and paper products for the bulk of their fiber supply. It is hard to imagine that a manufacturer in Alaska would be competitive under these circumstances. Again, MDF would provide for some cost recovery with the added option of secondary manufacture. The minimum fiber requirement for an MDF plant is estimated at 80 MMBF (log scale equivalent).

Acid Catalyzed Organosolv Saccharification (ACOS). This unique, high pressure, high temperature, closed loop, pulping process has been developed and patented by chemist Dr. Laszlo Paszner (Paszner Technologies, Inc., of Surrey, B.C.) of the University of British Columbia. Although it is adaptable to Alaskan species, both hardwoods and softwoods, the process has yet to be proved commercial for the Alaskan environment.

ACOS totally dissolves lignocellulosic material into a liquid that is then refined (fermented) into both sugar and lignin products. This is a 100 percent utilization of low grade wood (limbs, needles, bark, bole) of any shape or condition, or species. The products range from ethanol and xylitol (wood sugar) from the holocellulose and further products, including medicinals, from the lignin. ACOS uses catalyzed acetone to effect the hydrolysis. ACOS is the preferred system for fuel (ethanol) or sugars.

A related process, HP-ALPULP, using catalyzed ethanol or methanol, simply dissolves the lignin, resulting in delignified wood fibers and liquid chemicals. The wood fibers (pulp) are available for bleaching or other uses in paper or board manufacture. The liquids are then refined into xylitol, vanillin, ethanol, etc. HP-ALPULP is preferred in areas where wood pulp is a desired product, recovering about one-half of the biomass as pulp. Dr. Paszner also holds a worldwide patent for this process.

Commercial products resulting from the process include very strong (equal or exceeding Kraft quality) unbleached or bleached (using alcohol and peroxide) wood pulp and wood chemicals (ethanol, xylitol, vanillin, lignin, Ca/Mg fertilizer). The chemicals include fuels, food products (including sugar substitute sweeteners), lignin, and vitamins. Potential customers include paper or paperboard mills, adhesive makers, soft drink bottlers, bakeries, health food manufacturers (antioxidants), livestock feed manufacturers and petroleum refineries requiring ethanol as a fuel additive to reduce pollution from internal combustion engines. In some instances, the residual chemicals may be worth more than the pulp.

Mechanically, the systems do not differ greatly from any other chemical pulping method (sulfite, sulfate), but do have the distinct advantage of being closed loop systems. There are no discharges causing air or water pollution. Because it appears the plants can be built without expensive air or water treatment and recovery systems, the plants could theoretically be constructed for about one-third the cost of traditional chemical pulp mills. This indicates that smaller mills (250 tons/day) could and perhaps should be constructed and operated close to raw material sources.

Chemically, this process is a world apart from conventional chemical pulping. The alcohols are simpler to handle compared to the traditional sulfur chemicals, which are the source of much of the air and water pollution associated

with typical Kraft pulping. The digester must be able to withstand greater pressure and temperature than is the norm, but this is not a physical problem as the digester would be well within pressure vessel limits.

Other organosolv pulping processes include the hardwood only ALCELL® process which has undergone large scale testing in eastern Canada, and the ORGANOCELL® process (also hardwoods only) developed in Germany. The ACOS process was recently selected by SFTI (the Swedish Forest Products Laboratory) as the “most desirable process” to be upscaled to commercial production. This recommendation was given after the top eight biofuels conversion technologies were reviewed by the Swedish panel.

More information on the ACOS process and efforts to bring it to a commercial scale can be obtained from Mr. Terry Brady at Husky Wood and Forestry Services (907)333-9462.

Ethanol. Ethanol is a high-octane liquid fuel that contributes little, if any, net carbon dioxide to the atmosphere during production and use. Neat ethanol is relatively low in toxicity, water soluble and biodegradable, making the consequences of large fuel spills less environmentally threatening. Today, most U.S. Ethanol production is based in the large grain-growing states in the Midwest where corn and other starch crops are used to produce approximately 1 billion gallons of ethanol annually. Because the anticipated demand for ethanol will eventually push up grain prices, the Department of Energy (DOE) is concentrating its efforts on developing an alternative, low-cost feedstock—cellulosic biomass.

A major by-product of the biomass conversion process is lignin, a clean burning, high BTU component of the original wood feedstock. Lignin is the precursor to coal, having the same BTU energy content, but without the sulfur found in coal. The lignin can be burned in boilers to produce steam and electricity for the ethanol plant as well as for an integrated lumber mill. The lignin could also be used to fire a boiler or converted to other chemicals such as resin or glue. A biomass to ethanol plant has the capacity to produce excess electricity and steam at a very reasonable cost. Both could be used by other manufacturers or the host community.

The National Renewable Energy Laboratory (NREL) studied the feasibility of converting the Ketchikan pulp mill to a biomass ethanol production facility which would produce fuel grade ethanol from pulp chips, hogged fuel, and wood waste. As would be expected, the existing assets at the KPC mill site greatly enhanced the economic viability of the operation.

The analysis looked at a plant sized to meet the ethanol needs of the Anchorage oxygenated fuels market (8 million gallons annually). Per EPA regulations, both Fairbanks and Anchorage are carbon monoxide (CO) non-attainment areas. Anchorage now uses ethanol to oxygenate its fuel while Fairbanks has temporarily been exempted from the oxy-fuel program. Oxygenated fuels reduce tail pipe CO emissions by enhancing more complete combustion of gasoline. An Alaska state excise tax exemption of \$0.08 per gallon of gasoline containing 10 percent by volume ethanol (or \$0.80 per gallon of ethanol) makes importing ethanol from outside Alaska feasible. Governor Knowles recently signed legislation extending this tax exemption for five years.

The proposed biomass conversion plant would require 220.6 metric tons (52.9 MMBF equivalent) of feedstock per year and employ 50 people. With regard to profitability, unfortunately, there was a wide margin of error around most of the

study findings. For instance, capital costs and total annual operating costs were estimated at \$17.4 million and \$13.8 million respectively, plus or minus 30 percent. Also, NREL emphasizes that the costs of ethanol production are highly sensitive to the cost of the feedstock delivered. They estimate an average delivered cost of \$40/BDT. However, a study completed for the Alaska Energy Authority in 1993 calculates wood residue costs of nearly double those use by NREL. Clearly, as NREL points out, a more detailed and in-depth study of the KPC site and other sites in Southeast Alaska is recommended.

More information on the biomass to ethanol process in general and, more specifically, the work completed for Southeast Alaska, can be obtained from Mr. Norm Hinman at NREL in Golden, Colorado (303)275-4481.

Laminated Veneer Lumber (LVL). LVL is made from wood veneer peeled from Douglas fir, southern pine, yellow poplar, lodgepole pine, and western hemlock logs. The veneer is dried, ultrasonically graded for strength, and then permanently bonded together in a continuous press using adhesives, heat, and pressure. Unlike plywood, the grains of the veneers used in LVL run parallel to one another. This manufacturing removes and disperses the natural defects inherent in wood and produces a product that is substantially stronger, more dimensionally stable, and more even in moisture content than solid lumber.

Because the manufacturing process neutralizes the natural defects in a log, LVL can be manufactured from lower grade and small diameter logs. The process of peeling the veneer off the log to make LVL allows the manufacturer to use 30 percent more of each tree in comparison to solid lumber.

TimberStrand® Laminated Strand Lumber (LSL) and Parallam® Parallel Strand Lumber (PSL). These products are just two examples of the engineered wood products on the market today. Parallam® is one of the strongest wood products on the market and is especially well-suited for headers, beams, columns, and posts in housing construction. Parallam® is made from 2- to 8-foot-long veneer strands that can be taken from small diameter, second-growth Douglas fir, southern pine, western hemlock and yellow poplar trees. These strands are dried and then bonded using adhesive via a microwave pressing process protected by 14 international patents. The result is a rectangular block of wood — or billet — that is longer (up to 66 feet), thicker, and stronger than the original trees from which it was made. This technologically advanced process can convert up to 80 percent of a whole log into high-grade structural lumber.

TimberStrand® is made from aspen or poplar logs cut that are cut into 12-inch strands. The strands are dried, treated with a polyurethane resin and aligned parallel to each other to take advantage of the wood's natural strength. The strands are then pressed in a patented steam injection process into massive, solid, 2.5 ton billets of wood. This process can convert up to 75 percent of a whole log into high quality structural lumber. The manufacturing process has zero water discharge and the drying and press systems in the production line are designed for low air emission. According to TrusJoist MacMillan (TJM), developers of both the Parallam and TimberStrand processes, a TimberStrand® plant would consume 123 MMBF (log scale equivalent) of fiber annually. TJM promotes the fact that Timberstrand is manufactured from plentiful, fast-growing, inexpensive trees (i.e. aspen and poplar) and not old growth timber. Although Alaskan species should be perfectly acceptable from a technical standpoint, the company may not be especially anxious to jeopardize this marketing strategy.

Fish/Wood Waste Compost. Composting is the process of letting nature transform organic materials into a humus material with many environmentally beneficial applications. In natural surroundings, leaves and branches that fall to the bottom of a forest form a rich, moist layer of mulch that protects the roots of plants and provides a home for nature's most fundamental recyclers: worms, insects, and a host of microorganisms and bacteria too small to see with the naked eye.

Through this biological process, soil-enriching compost, carbon dioxide, heat and water are all produced. By properly managing air and moisture, the composting process can transform large quantities of organic material (e.g. fish scraps and wood wastes) into compost over a relatively short period of time.

Compost can be utilized in countless environmental applications including landscaping, horticulture, forestry, agriculture, mine reclamation, road side erosion control, storm water treatment, and wetlands restoration. Compost is useful in these applications by improving the structure of soil and helping to retain moisture and minerals and controlling pests and fungi. In clay or sandy soils, compost also increases porosity that allows plant roots to more easily penetrate soils and surface water to drain between particles. Compost can be beneficially applied to lawns, gardens, athletic fields, shrubs and trees, and nursery and container plants.

The two main ingredients needed for making fish compost are fish wastes, and wood wastes, such as sawdust (or screened hogged fuel). The sawdust serves as a bulking agent, and has two purposes: 1) it allows air to enter the pile so bacteria and fungi can work, and 2) it provides a proper carbon-to-nitrogen ratio so the material will compost efficiently without offensive odors. Shredded bark, sawdust, and/or wood shavings satisfy both needs. Another advantage of using wood wastes is that it is abrasive and scratches the fish tissue, providing more surface area and easier entry for the bacteria and fungi to decompose the fish.

For large scale fish composting operations (more than 1,000 pounds per day) it is necessary to have the bulking material (such as sawdust and shavings) on site so that it can be quickly mixed with the fish scrap. When the fish wastes are mixed in with the wood quickly (less than 1 hour) the wood immediately absorbs the odor caused by nitrogen in the fish. It is also necessary to have the proper aerating equipment, such as a windrow turner. Proper turning will keep the piles at the right temperature and will also maintain the proper oxygen levels needed for efficient decomposition.

The required materials—fish wastes and wood wastes—are in plentiful supply in several southeastern Alaskan communities. According to Mr. Bob Williams of Ecotech, an investment of \$1-\$1.5 million can generate \$6-\$6.5 million in sales and 60-90 jobs. The potential sales value of \$70-\$200 per cubic yard comfortably exceeds the estimated production cost of \$20 per cubic yard. Compared to other economic development possibilities, fish waste composting in Alaska is uniquely appropriate. The capital required to generate jobs is low to moderate, the technology is minimal, and the raw materials are plentiful.

More information on the composting of fish and wood waste can be obtained from Mr. Bob Williams of Ecotech at (541-994-6826) or rwilliams@wcn.net.

Energy. The concept of using waste wood for energy production is commonly discussed. (Cogeneration - Production of both electricity and useful thermal energy from a common fuel.) Waste from sawmill and planing operations can be burned and converted to steam for power generation and lumber drying. Such use of "hog fuel" has been widespread and well-proven in Alaska and elsewhere. Currently, the Ketchikan Pulp Company is producing limited electrical power at its 38 megawatt hog fuel-fired Ward Cove power plant, fueled by residue from the Ketchikan sawmill and the Annette hemlock mill. Most of the power is used by the Ketchikan sawmill, although some has been sold to the local utility. Other Alaskan wood-fired power plants have operated in Haines, Sitka, Wrangell, and Klawock. At present, 129 wood processing facilities and three stand-alone plants in Oregon and Washington produce power and/or heat from wood. Feasibility of such energy facilities is linked to a number of factors, including the availability and cost of diesel fuel and utility power, and the cost and environmental impacts of alternative means of disposal.

The Bioenergy Program for Alaska is a federally funded program within the State Department of Community and Regional Affairs to promote the use of low grade timber, forest and mill wood waste, municipal solid waste and agricultural byproducts for energy recovery. Over the last few years, a number of studies have been conducted under the auspices of this program to assess the feasibility of using surplus biomass for electrical generation. A brief description of each of the study findings is provided below.

South Tongass Wood Waste Assessment (1993). Investigated the availability and cost of hogged fuel and logging residues in southern Southeast. Assessed fuel quantities and costs for four potential power plant locations.

FINDINGS: At the time the report was published, the five mills owned by the Ketchikan Pulp Company and the Alaska Pulp Corporation were producing an estimated 58,500 bone dry tons (BDT) of residue per year. Around 70 percent of this material was being used at the two pulp mills for power production and process stream, leaving 19,000 BDT/yr for other uses. An additional 17,600 BDT/yr was available from the Thorne Bay log sort yard, yielding a yearly total of approximately 37,000 BDT. Delivered cost of the material to Ketchikan, Metlakatla, Thorne Bay, and Klawock ranged from \$29.24 to \$100 per BDT depending on its source, including processing, handling, and transportation. Wood waste moisture content in the region is high at 60-65 percent, indicating the need for fuel treatment prior to energy recovery. The report also estimated costs of recovering logging residue from cut-over areas and landings, as well as supplementary fuels, such as refuse-derived fuels and coal.

Given the significant changes in the forest products industry since the report was published, an update of the assessment is planned for 1997.

Thorne Bay Wood-Fired Power Plant Feasibility Analysis (1995). Assessed the feasibility of a 1.5-2.0 mW wood-fired power plant and community lumber drying and surfacing operation.

FINDINGS: The City of Thorne Bay decided that, for the present, plans to install a 1.52.0 mW power plant fueled by Ketchikan Pulp Company's sort yard waste wood do not pencil out. Utilizing the 40,000 tons of cull logs,

trim, bark and other debris for fuel, the City had hoped to replace the City's 400 kW diesel power system and provide heat for lumber drying as a stimulus for additional wood product market development. Another motivation of Thorne Bay was to eliminate air quality impacts of open burning of wood waste in the sort yard and avoid the need for a new wood waste landfill.

The study projected capital costs of a conventional wood power plant, community lumber drying facility, wood yard, power distribution system, and associated equipment at \$11.3 million if purchased new. (Reconditioned equipment would cost substantially less.) Faced with an attractive bid by Alaska Power and Telephone to link the city to its newly-developed Black Bear hydro project and high costs for the wood-fired plant, the City dropped its plans to convert its waste to energy.

Klawock Viking Sawmill Boiler Assessment (1995). Assessed the feasibility of retrofitting power boilers to burn Craig/Klawock solid waste.

FINDINGS: Due to substantial modifications that would be necessary in the fuel handling and storage, combustion, heat recovery, and pollution control systems, the assessment recommended against retrofitting the facility for solid waste incineration.

Juneau Waste-to-Energy Assessment (current). Assessed feasibility of recovering power and heat from Channel Corp. Juneau waste incinerators. Waste heat would be used for lumber drying and space heating.

FINDINGS: The energy equivalent to around one million gallons of fuel oil is lost annually up the stack of Juneau's municipal solid waste incinerator. However, the production and sale of electricity is not economically feasible due to a current surplus of inexpensive hydropower. The potential opportunities for cost-effective energy recovery are:

1. A step increase of electrical demand on Juneau's system, such as from a mine or sawmill, or the continued gradual increase in demand over time. Under such conditions, a power generation facility, coupled with an expanded incineration system and tax-exempt financing, would become attractive.
2. Location of a large nearby market for thermal energy sales for space heating or process heat. A wood processing facility with a need for heat, power, and waste disposal might provide such a market.

Pelletized Fuel/Presto Logs. No site specific work has been performed on this topic. The DCRA Division of Energy, however, maintains a base of information, including feasibility assessment software.

More information on the use of wood and other biomass for energy can be obtained from Peter Crimp, Alaska DCRA Division of Energy, (907) 269-4631 or PCrimp@comfreak.state.ak.us.